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CRUISE REPORT: R/V CHAIN 107, 22 OCTOBER - 10 NOVEMBER 1972

J. Gifford

Woods Hole Oceanographic Institution

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CHAIN 107 carried out mooring work from 22 October to 10 November, 1972. Eight moorings, set on previous cruises, were retrieved, two five-month moorings set, and four moorings were set and retrieved before the end of the cruise to perform an experiment for MIT. Work was done in the areas of the Continental Slope, Sites D, D_1, L, and the MODE Site (all in the western North Atlantic).

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WHOI-73-4

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CRUISE REPORT
R/V CHAIN 107, 22 October - 10 November 1972

By

J. Gifford, Chief Scientist

WOODS HOLE OCEANOGRAPHIC INSTITUTION
Woods Hole, Massachusetts 02543

January 1973

TECHNICAL REPORT
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Ferris Webster, Chairman
Department of Physical Oceanography

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Many thanks to those who took part in the preparation of and who participated in a most busy and successful cruise. Thanks, also, to those involved in the editing, typing and preparation of this report.

Cruise Report
R/V CHAIN 107, 22 October - 10 November 1972
J. Gifford, Chief Scientist

CHAIN 107, a single-leg cruise, Woods Hole to Woods Hole, was scheduled to perform the following work:

Buoy Work

1. Slope
   (a) Check of near-bottom five-month moorings (Station 458, 459 and 460)

2. Site D
   (a) Check of intermediate five-month moorings (Stations 465 and 466)

3. Site D_1
   (a) Check of five-month near-bottom mooring (Station 461) and five-month intermediate mooring (Station 468)

4. Muir Seamount
   (a) Retrieve five-month intermediate moorings (Stations 456 and 457)

5. MODE Site
   (a) Retrieve five-month surface moorings (Stations 451, 453, 454 and 455)
   (b) Retrieve five-month intermediate mooring (Station 452)
   (c) Set two intermediate five-month moorings
   (d) For MIT there were three near-bottom and one intermediate mooring to be set, all to be retrieved before the ship's return to Woods Hole

6. Site L
   (a) Retrieval of near-bottom twelve-month corrosion test (Station 494)

Other Experiments

1. Regular hydrographic stations:
   (a) Standard sections along 70° W., stations to the bottom, between 40° N. and 39° N.
   (b) Station to the bottom at Site L
   (c) Stations to the bottom at MODE Site

2. CTD stations in MODE area and northward along 70° W.
   (a) Density section across Muir Seamount

CHAIN 107 departed Woods Hole at 1615 on 22 October, 1972, headed for the Continental Slope where the first of a number of acoustic checks was made on moorings previously set there and at Sites D and D_1. Checks at these locations showed that all transponders and reply pingers of Stations 458, 4[illegible], 459, 460, 468, 461 and 465 were working properly. These moorings were to be retrieved in December of 1972.

At the Muir Seamount, 135 miles northeast of Bermuda, two intermediate moorings had been set in June. Station 456 was set in 2,998 meters of water and 457, approximately sixteen miles to the west, was set in 4,817 m. of water. The ship heaved to twenty-three miles west of Station 457 for the first hydrographic station and then continued toward that station, beginning to transpond on its acoustic release at a distance of seven miles. The ship steamed almost directly over the site where the mooring had been set but no signals were received from either the transponder or the reply pinger. All output levels and ranges were tried with no success. The release was triggered frequently with all hands stationed on the bridge for a visual sighting. After considerable time spent in this location it was decided to end the search and assume the mooring to be lost.

On the way to Station 456, we lowered the transducer head from the "White Horse" over the side and received a signal from 456's release at a distance of 13.2 kilometers. With the 301 hull-mounted transducer we received a signal at 10.8 kilometers and were able to transpond on release and receive good signal while approaching the mooring at 12.5 knots. The mooring released in normal fashion, the radio float was

picked up and retrieval begun. As a result of a bad wire angle leading under the hull, the end of the wire-rope shot and beginning of the first nylon shot were disconnected. Two meters of chain were attached to the nylon and dropped over the side. With the mooring clear of the hull the ship was maneuvered alongside the glass balls and the remainder of the mooring was hauled with no more difficulty. A hydrostation completed the work in the Muir-Seamount area.

The ship then proceeded south to Station 453, the eastern-most station in the MODE area. This mooring and Stations 451, 452, 454 and 455 were five-month surface moorings to be retrieved later on during this cruise. Close inspection disclosed that neither the radio nor navigation light on Station 453 were operating and a visual inspection of Station 455, to the westward, showed that here the light was working but not the radio.

In order to insure enough time to carry out the mooring-dynamics experiment planned for M.I.T. in the MODE area, (see Appendix I) the decision was made to make a bathymetric survey of the area and set the moorings as soon as possible. While the survey was in progress the gear and instrumentation were set up for launching. With the survey completed, the ship steamed downwind six miles, made a 180° course change and started streaming the gear for Station 469. This was a five-day intermediate mooring with forty-four items and took approximately three and one-half hours to set. While the anchor was settling, the gear for the first transponder mooring was prepared. Transponder moorings Stations 470, 471 and 472 were set in succession with the toroid of Station 455 as a reference point determined by radar ranges and bearings.

The ship then returned to Station 453 and it was retrieved in normal

fashion. After finishing two CTD stations at this position a new five-month intermediate mooring (Station 473) was set.

The ship went on to make a visual sighting of Station 455 and continued westward to Station 452 where two CTD stations were made and Station 452 retrieved without incident.

Station 454, to the southeast, responded acoustically as we approached and was retrieved with no problems. Three CTD stations were taken at this location.

Station 451, to the north, was approached and a signal received at 11.5 kilometers. The release had to be triggered twice before it would fire but all gear was retrieved without further incident. It should be noted that numerous fishbites were observed on the 400-meter shot of wire rope, some quite severe, and particles of teeth were embedded in the jacket of the 100-meter shot of wire.

In order to continue with the CTD stations in the MODE area and insure a minimum of five days for the M.I.T. experiment, two more CTD stations were made at the location of the retrieved Station 453 and three at 452's location.

The ship then steamed north to Station 455 and the M.I.T. mooring array. A good signal was received from the lower transponder of the main M.I.T. mooring, Station 469, at 9.36 kilometers. At the station, the upper acoustic release was enabled and the release triggered. The ship came alongside and picked up the radio float and began to retrieve the mooring. Thirty-eight of the items on this mooring were retrieved, leaving the lower release and glass-ball flotation section in place for use in the M.I.T. acoustic survey. For this survey ranges and bearings of all four transponders were made from various stations and positions using the "White Horse" transponding head lowered over the

side.

With the survey completed, the ship returned to the location of the retrieved Station 454 to make three more CTD stations.

Returning to the M.I.T. array, the lower section of Station 469 was triggered and recovered without incident, as were Stations 470, 471 and 472. In addition, the remaining five-month surface mooring set in May was retrieved intact and replaced with Station 474, a new five-month intermediate mooring.

With all experiments at the MODE Site complete, the ship proceeded north along 70° West with the intention of making CTD stations at every degree, as far north as 40° North.

At 29° 10' N., 69° 38' West the ship stopped to check a mooring for the University of Rhode Island. They had set this mooring some time before and had since been unable to get an acoustic response from it. We, too, were unable to get a response to our interrogation.

By the time the ship arrived at Station 404 at 34° N., 70° W., the weather was overcast and rough and it was becoming dark. Although the release had responded and had been enabled for firing, it was decided to disable the release and wait until the following morning to retrieve the mooring.

In the meantime, a hydrographic station and two CTD stations were made. When this station, which was a near-bottom engineering mooring, was retrieved the next day it had been on station for twelve months and eleven days. By 0729 all gear was successfully on board.

Notes on Station 404

1. There was considerable rust on the buoy's stainless-steel bales.
2. The nuts and bolts securing buoy framework were rusting.
3. The hard hat nuts and bolts were quite rusty.

4. The VACM case and rotor cage had corrosion on paint work.
5. The current meter case leaked, evidently when the meter was brought to the surface. Water came up to the bottom of the battery platform but did not seem to affect the magnetic-tape record or the electronic boards. The current meter ran for 330 days and the rotor stopped after 150 days.
6. The titanium case was very clean and free of corrosion although the thimbles, shackles and sling ring were very rusty on one end.
7. Some rust and corrosion were found on the edge of the stainless-steel bands that hold the main support rod to the release case. The end of the release case near bolt holes was quite corroded and the anode completely gone. The nut and lock washer on the release bale were partially corroded away.
8. The stainless steel cotter pins of alloy 316 were extremely bright and free of corrosion.

Considering the amount of time this mooring had been at sea, everything looked in pretty good condition. Numerous pictures were taken as this mooring came aboard.

The ship then continued north, taking CTD stations en route, as planned.

By late afternoon on 8 November rough weather with high winds made it impossible to maintain a satisfactory wire angle. All stations were cancelled and the ship jogged until the next morning when it was possible to head north-northwest for Woods Hole at four knots. Later in the day the weather subsided enough to make better speed and the ship continued steaming throughout the day and the night, arriving in Woods Hole at 0930 on 10 November.

Experiments Initiated and/or Completed on CHAIN 107

Completion of Muir Seamount Experiment (study of semi-diurnal tidal motions in this area) - Stations 456 and 457 - C. Wunsch, M.I.T.

Long-term current studies at the MODE Site - Stations 451, 452, 453, 454, 455 - W. Schmitz

Twelve-month engineering corrosion test at Site L Station 404 - R. Walden

Complete retrieval and installation of corrosion samples - S. Dexter

Mooring-dynamics experiment at MODE - Stations 469, 470, 471, 472 - J. Dahlen, Draper Lab, M.I.T.

30 CTD Stations)
3 Hydrographic Stations) - G. Volkmann
12 XBT's) N. Fofonoff

Personnel

James E. Gifford, Chief Scientist
R. David Simoneau
Charles F. Simmons
Roderigue A. LaRochelle
Gordon H. Volkmann
Nick P. Fofonoff
Clayton W. Collins, Jr.
Joseph Poirier
Steven C. Dexter
Edward Gough
Christopher F. Polloni
Richard L. Koehler
Stanley Hayes
William M. Young
Robert McGee, M.I.T.
John Dahlen, M.I.T.
Narender Chhabra, M.I.T.
Ross Hendry, M.I.T.
Jean Bervas, French Government - Guest Investigator - Engineer
Jean Michel Coudeville, Guest Investigator, France - Engineer

Appendix I

SUMMARY OF CRUISE ACTIVITY -

MOORING MOTION EXPERIMENT, CHAIN 107

22 October 1972 - 10 November 1972

The mooring experiment carried out during this cruise was the oceanographic part of an analytical and experimental study of techniques for optimum interpretation of oceanographic measurements obtained from non-stationary moored buoy systems.

The immediate objective was to measure the motion of a point near the upper terminus of a well instrumented sub-surface mooring. Primary data would take the form of VACM readings, pressure and temperature records, as well as acoustic travel time measurements from the acoustic transmitter termed the "white horse" to four points on the ocean floor. Data taking was planned to extend over a span of five days.

The entire array consisted of a main mooring of approximately 5000 meters length and three transponder moorings each of 55 meters length. Desired configuration was a roughly symmetrical arrangement. The three transponder moorings were to be spaced nominally 120° apart on a circle of 2.8 Km. radius centered near the anchor point of the main mooring. Some decentering was required as it was necessary that acoustic travel times all differed by at least fifty milliseconds to eliminate possible signal interference at the timing electronics. Angular spacing of transponder moorings relative to the main mooring was not felt to be critical - the chief requirement being that in the event of failure of one transponder, angular separation of the remaining ones should be adequate to determine both horizontal components of mooring motion.

As with most moorings cruise activity is best described in two phases - deployment and recovery.

On 28 October 1972 the deployment phase was begun with a fathometer survey of the mooring area. The objectives here were to verify flatness of the sea floor and also to measure its depth. This data would later be corroborated with mooring pressure measurements. A rectangular survey pattern was established by using radar range and bearings to the surface toroid of station No. 455.

Upon completion of the survey R/V CHAIN ran to a position downwind of the survey area. Main mooring deployment then commenced at 1325 EDT with the ship heading into the wind. When the main mooring had been about two thirds deployed, a large tanker was observed closing on the port beam. This vessel, not responding to signals, altered course to pass approximately one nautical mile behind the CHAIN. Timely action by the Chief Scientist in stopping the CHAIN allowed unbuoyed portions of the mooring line to sag. The tanker passed over one of these depressed sections without incident. Mooring deployment then continued with anchor drop at 1721 EDT.

Radar Range and Bearing measurements to Station #455 combined with acoustic range measurements to the main mooring were then used to locate the drop points for the three transponder moorings. Anchor drop for the third transponder mooring took place at 2041 EDT. CHAIN continued along same heading to obtain two satellite navigation fixes to establish a geographic reference for mooring array. In the morning CHAIN returned to the main mooring area. Six sets of acoustic ranges were then obtained by interrogating all transponders. This survey verified transponder locations and acoustic operation in general.

Experiment mooring recovery began on 3 November 1972, starting with the recovery of the main mooring. The mooring was released via its upper transponder so that the anchor transponder remained in place for the acoustic net survey which followed. Survey consisted of lowering the "white horse" transducer into the water with ship stopped at eleven locations throughout the mooring area.

Survey ended at dusk. Weather forecast being good, recovery of the four transponders was postponed till daybreak as the main mooring anchor transponder had neither radio nor beacon. All four transponder moorings were recovered by late morning of 4 November.

In summary, the oceanographic part of the experiment went off well. All moorings were properly deployed. Deployment configuration was within tolerance. All moorings were recovered. Furthermore, the entire assemblage of acoustic equipment operated properly, and all other recording instruments, with two minor exceptions, appear to have done so as well.

Robert J. McGee

Appendix II

Summary of Fouling, Fishbite and Corrosion Data

Obtained on CHAIN 107, October 1972

The following data apply to Stations No. 451, 452, 453, 454, 455, 456 and 469. Station 404 will be covered in a separate report.

Biofouling

Goose barnacles were found at all rigid bridle junctions both at the toroid and the tension recorder on all four surface toroids. On the toroid itself, scattered goose barnacles covered about 1% of the submerged area on Stations No. 451, 453 and 454, and 10 to 25% of the submerged area on Station No. 455.

Heavy slime covered 90 to 100% of all components down to about 100 meters on the four surface moorings. Some scattered hydroids and algae were observed on Stations 453 and 455.

The biological goo that we have traditionally called "Sea Snott" was present in isolated clumps on the mooring lines of all stations except No. 456. This material is unidentified but some of it looks as if it might be partially decomposed garbage and trash.

In general it can be said that biofouling made recovery slightly more difficult but in no way endangered the structural integrity or scientific function of these moorings.

Fishbite

The accompanying plot summarizes the distribution with depth of the total number of fishbites on Stations No. 451, 452, 453, 454 and 455. Major bites are defined here as ones that either penetrated

all the way through the polyethylene jacket or were over 30 cm long or both. Also plotted is the general temperature profile of the MODE area taken from CTD data. As Stimson and Prindle have observed before, the zone of maximum fishbite activity corresponds quite closely to the main thermocline. The most serious bites occurred on Station 451 at about 500 m. Tooth fragments were recovered from two of these bites.

Corrosion

The only corrosion problem resulting in an instrument becoming inoperative was the parting by corrosion of the bronze bolt in the radio ground lead on the toroid at Station 451. The mechanism is hard to pin down but it probably involved some crevice corrosion aided by stray electrical currents. To correct this problem in the future we should:

1. Make sure the electrical contacts are good by using the proper hardware and tightening it down, i.e., make sure it is a low resistance joint.
2. Coat the outside of the joint (above and below the deck) with silicone grease or some flexible plastic or epoxy to seal off the crevices so corrosion cannot take place between the bolt and the connecting lugs.

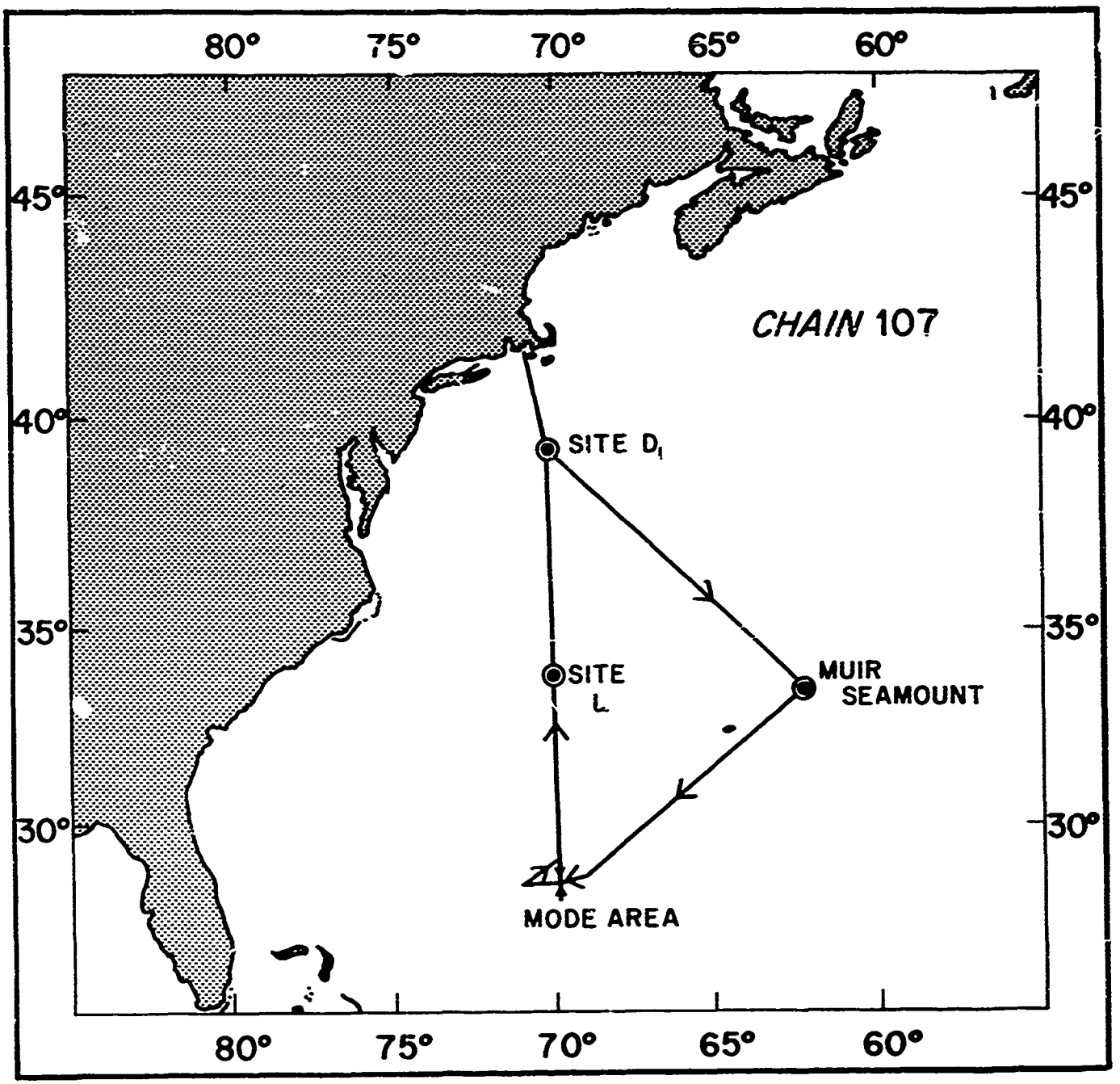
There were also minor problems in the following areas:

1. The stainless steel bands holding the glass balls in the intermediate radio floats. New bands should probably be used for any exposure greater than four months in duration.
2. The welds on the frame of the radio floats showed some deterioration and should be carefully checked before each

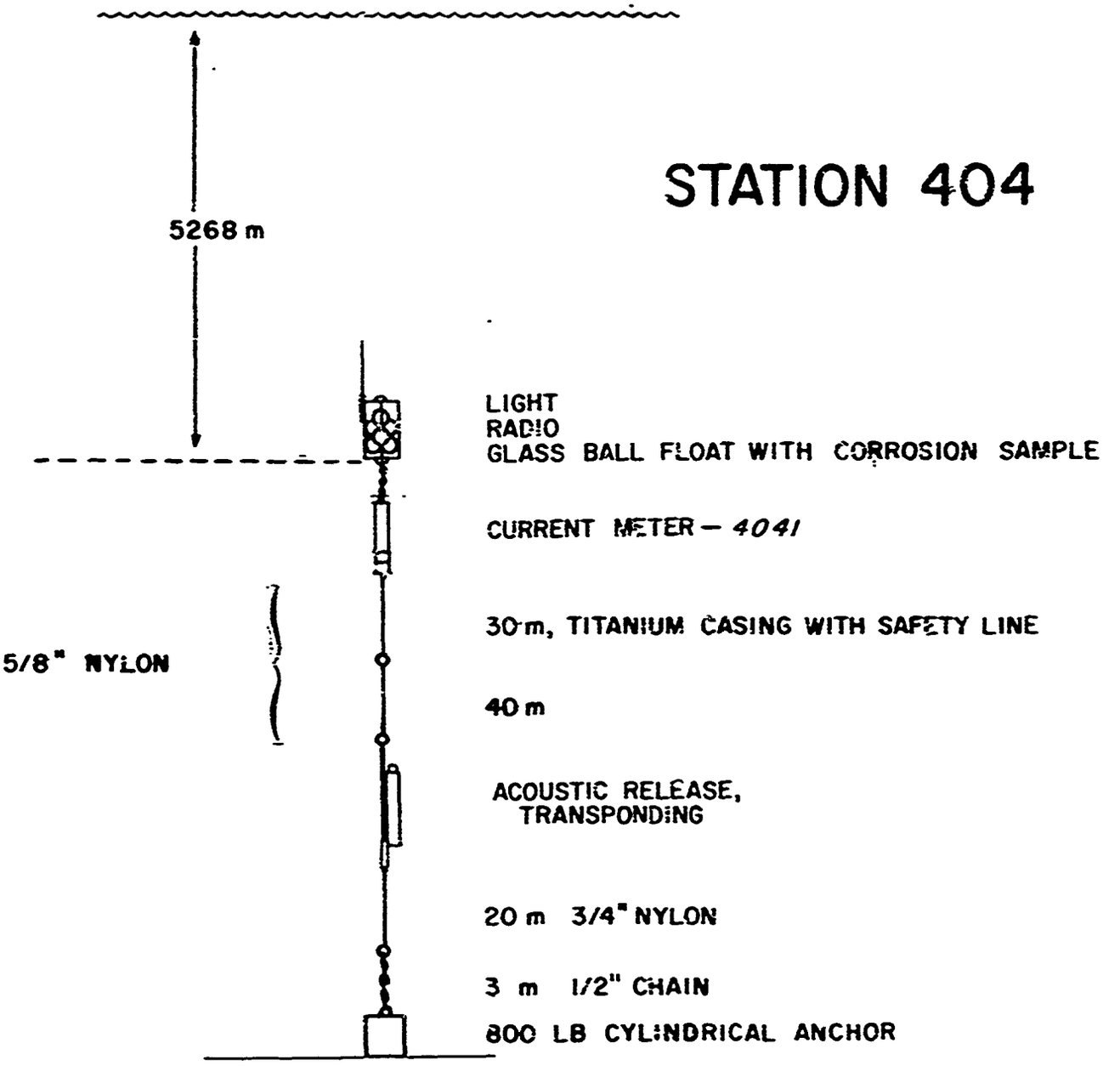
deployment.

3. When 304 stainless lock nuts are used on 316 stainless bolts as is often the case when fastening hard hats to chain, the nuts will suffer accelerated crevice corrosion. Even so they seem to have a useful submerged lifetime of about six months. It does not seem that their use would endanger the mooring provided that they are replaced before each deployment.

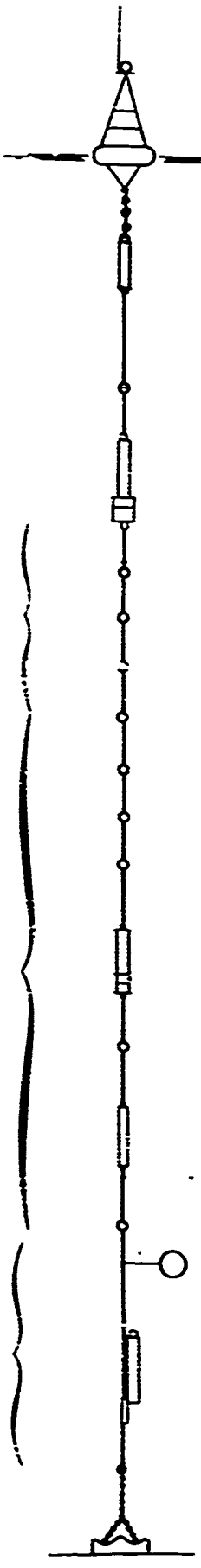
Stephen C. Dexter


80°
75°
70°
65°
60°
45°
40°
35°
30°
CHAIN 107
SITE D1
SITE L
MUIR SEAMOUNT
MODE AREA

STATION 404


5268 m
LIGHT
RADIO
GLASS BALL FLOAT WITH CORROSION SAMPLE
CURRENT METER – 4041
30 m, TITANIUM CASING WITH SAFETY LINE
5/8" NYLON
40 m
ACOUSTIC RELEASE,
TRANSPONDING
20 m 3/4" NYLON
3 m 1/2" CHAIN
800 LB CYLINDRICAL ANCHOR

STATION 45i



LIGHT
RADIO

10 m 1/2" CHAIN

TENSIOMETER, TELEMETERING - 4511

400 m 3/8" WIRE

100 m 5/16" WIRE

VACM - 4512

5/16" WIRE

300 m

200 m

500 m

500 m

500 m

500 m

500 m

500 m

5/8" NYLON

CURRENT METER - 4513

500 m

415 m

TENSIOMETER - 4514

120 m

37 16" GLASS BALLS IN NETS ON 85 m

3/4" NYLON

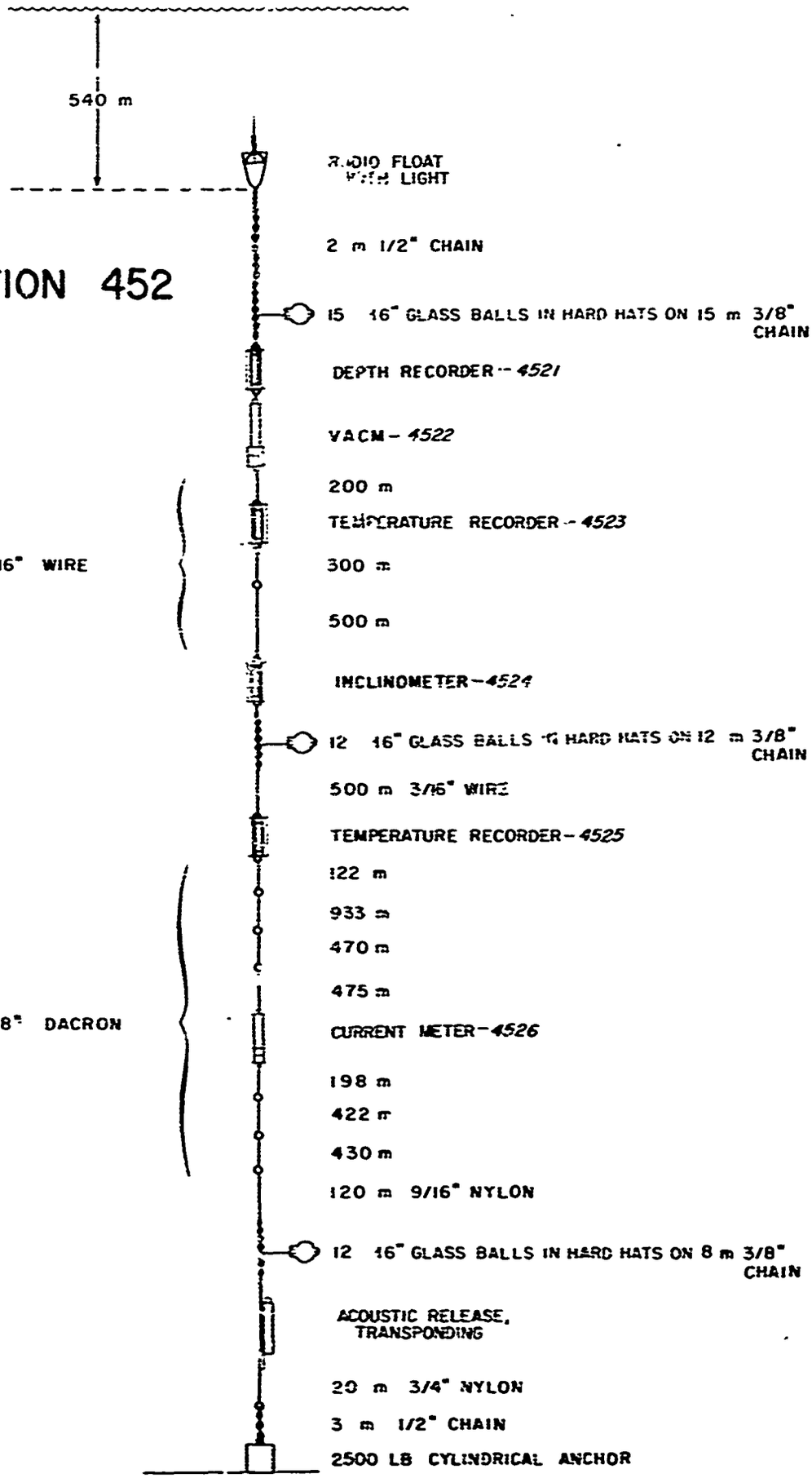
ACOUSTIC RELEASE,
TRANSPONDING

20 m

3 m 1/2" CHAIN

STIMSON ANCHOR, 5800 LBS

STATION 452


540 m
RADIO FLOAT
WITH LIGHT
2 m 1/2" CHAIN
15 16" GLASS BALLS IN HARD HATS ON 15 m 3/8" CHAIN
DEPTH RECORDER -- 4521
VACM - 4522
200 m
TEMPERATURE RECORDER - 4523
3/16" WIRE
300 m
500 m
INCLINOMETER - 4524
12 16" GLASS BALLS IN HARD HATS ON 12 m 3/8" CHAIN
500 m 3/16" WIRE
TEMPERATURE RECORDER - 4525
122 m
933 m
470 m
475 m
3/8" DACRON
CURRENT METER - 4526
198 m
422 m
430 m
120 m 9/16" NYLON
12 16" GLASS BALLS IN HARD HATS ON 8 m 3/8" CHAIN
ACOUSTIC RELEASE, TRANSPONDING
20 m 3/4" NYLON
3 m 1/2" CHAIN
2500 LB CYLINDRICAL ANCHOR

STATION 453

LIGHT
RADIO

TELEMETERING
TENSION CELL — *4531*

10 m 1/2" CHAIN

400 m 3/8" WIRE

100 m

VACM — *4532*

300 m

5/16" WIRE

200 m

500 m

VACM — *4533*

500 m w/CORROSION SAMPLE — *4534*

517 m

516 m

513 m

354 m

5/8" NYLON

TEMP./DEPTH RECORDER — *4535*

100 m

VACM — *4536*

500 m

2 17" GLASS BALLS IN HARD HATS ON 3 m 1/2" CHAIN

415 m

5/8" NYLON

TEMP./DEPTH RECORDER — *4537*

120 m

TENSIOMETER, — *4538*
(w/CORROSION SAMPLE)

37 15" GLASS BALLS IN NETS ON 85 m

3/4" NYLON

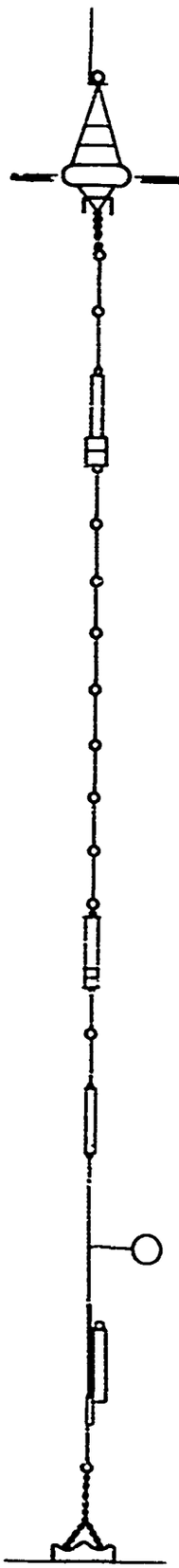
ACOUSTIC RELEASE,
TRANSPONDING

20 m

3 m 1/2" CHAIN

STIMSON ANCHOR, 5525 LBS

STATION 454



LIGHT
RADIO
WIND RECORDER – *4541*

TELEMETERING
TENSIOMETER CELL- *4542*

10 m 1/2" CHAIN

400 m 3/8" WIRE

100 m

VACM- *4543*

5/16" WIRE

300 m

200 m

500 m

500 m

517 m

473 m

544 m

466 m

5/8" NYLON

CURRENT METER– *4544*

576 m

339 m

TENSIOMETER,– *4545*

120

37 16" GLASS BALLS IN NETS ON 85 m

3/4" NY

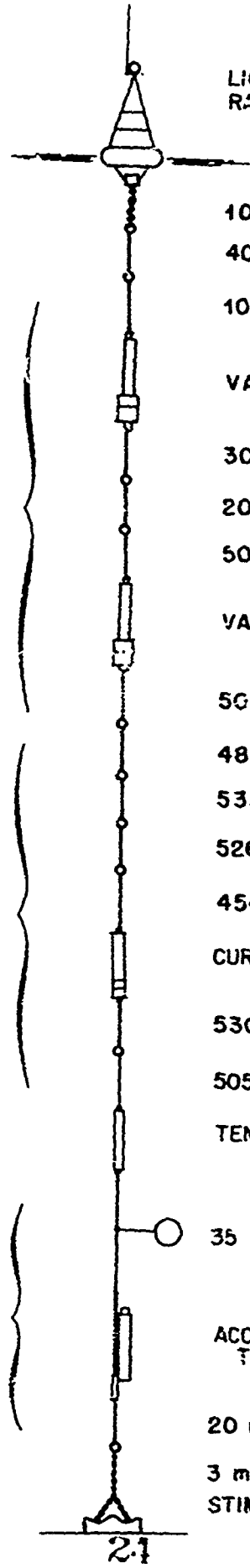
ACOUSTIC RELEASE,
TRANSPONDING

20 m

3 m 1/2" CHAIN

5525 LB. STIMSON ANCHOR

STATION 455



LIGHT
RADIO

TELEMETERING
TENSION CELL — *4551*

10 m 1/2" CHAIN

400 m 3/8" WIRE

100 m

VACM — *4552*

300 m

5/16" WIRE

200 m

500 m

VACM — *4555*

500 m

485 m

535 m

526 m

5/8" NYLON

454 m

CURRENT METER — *4554*

530 m

505 m

TENSIOMETER, — *4555*

35 16" GLASS BALLS IN NETS ON 85m

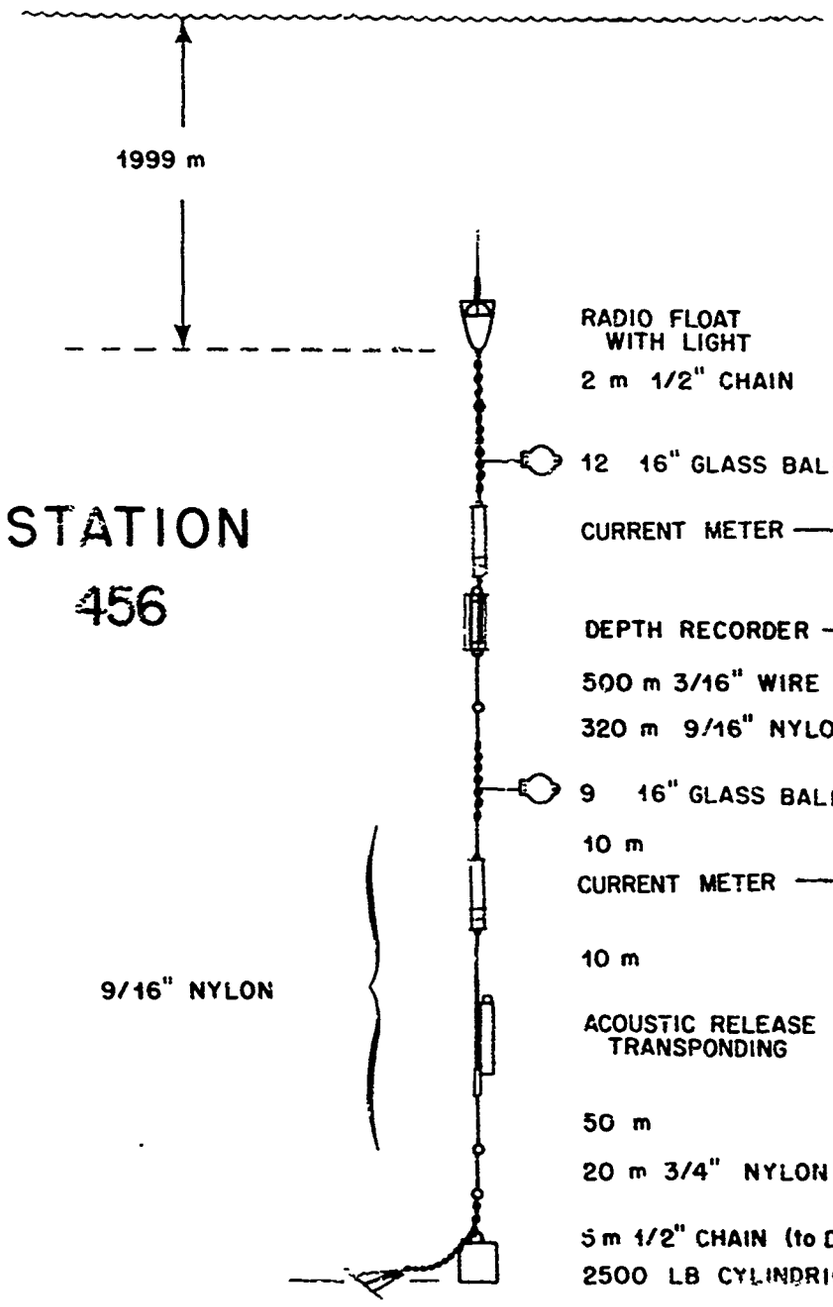
3/4" NYLON

ACOUSTIC RELEASE
TRANSPONDING

20 m

3 m 1/2" CHAIN

STIMSON ANCHOR, 6500 LBS



RADIO FLOAT
WITH LIGHT

2 m 1/2" CHAIN

12 16" GLASS BALLS IN HARD HATS ON 10 m 3/8" CHAIN

CURRENT METER — *4561*

DEPTH RECORDER — *4562*

500 m 3/16" WIRE

320 m 9/16" NYLON

9 16" GLASS BALLS IN HARD HATS ON 10m 3/8" CHAIN

10 m

CURRENT METER — *4563*

10 m

ACOUSTIC RELEASE
TRANSPONDING

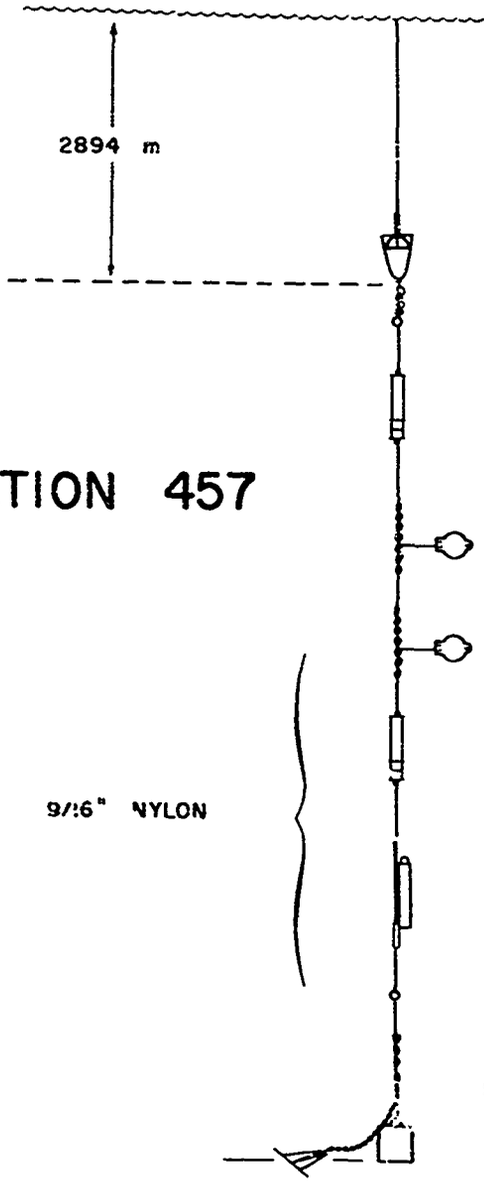
50 m

20 m 3/4" NYLON

5 m 1/2" CHAIN (to Danforth)

2500 LB CYLINDRICAL ANCHOR w/DANFORTH

STATION 457



RADIO FLOAT
WITH LIGHT

2 m 1/2" CHAIN

15 m 3/8" CHAIN

CURRENT METER – *4571*

1000 m 9/16" NYLON

5 16" GLASS BALLS IN HARD HATS ON 5 m 3/8" CHAIN

553 m 9/16" NYLON

5 16" GLASS BALLS IN HARD HATS ON 5 m 3/8" CHAIN

10 m 9/16" NYLON

CURRENT METER – *4572*

10 m

ACOUSTIC RELEASE,
TRANSPONDING

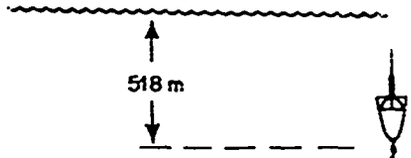
48 m

20 m 3/4" NYLON

5 m 1/2" CHAIN (to Danforth)

2500 LB CYLINDRICAL ANCHOR w/DANFORTH

STATION 469



RADIO FLOAT
WITH LIGHT

2 m 1/2" CHAIN

17 16" GLASS BALLS IN HARD HATS ON 15 m 3/8" CHAIN

VACM — *4691*

DIFFERENTIAL TEMPERATURE RECORDER — *4692*

2 m 3/8" CHAIN

TEMPERATURE/DEPTH RECORDER — *4693*

2 m 3/8" CHAIN

WHITE HORSE — *4694*

500 m 3/16" WIRE

6 16" GLASS BALLS IN HARD HATS ON 5 m 3/8" CHAIN

VACM — *4695*

500 m 3/16" WIRE

5 16" GLASS BALLS IN HARD HATS ON 5 m 3/8" CHAIN

VACM — *4696*

500 m 3/16" WIRE

INCLINOMETER — *4697*

2 m 1/2" BRAIDED DACRON

TEMPERATURE/DEPTH RECORDER — *4698*

423 m 3/8" DACRON

5 16" GLASS BALLS IN HARD HATS ON 5 m 3/8" CHAIN

VACM — *4699*

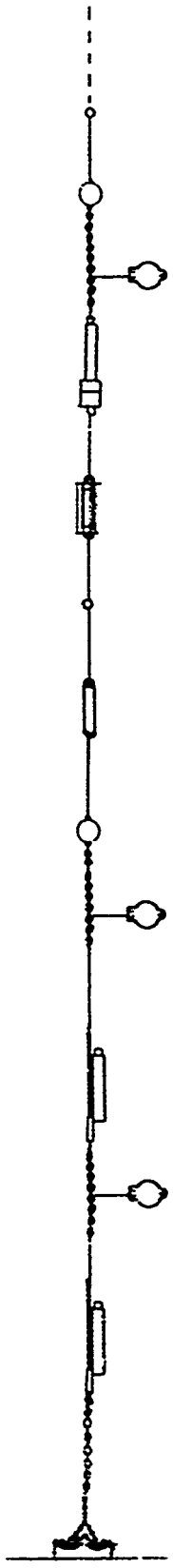
935 m 3/8" DACRON

INCLINOMETER — *46910*

CONTINUED

CONTINUED

469



2 m 1/2" BRAIDED DACRON

TEMPERATURE / DEPTH RECORDER — *46911*

5 16" GLASS BALLS IN HARD HATS ON 6 m 3/8" CHAIN

VACM — *46912*

555 m 3/8" DACRON

INCLINOMETER — *46913*

933 m 3/8" DACRON

267 m 3/8" DACRON

TENSIOMETER — *46914*

2 m 1/2" BRAIDED DACRON

TEMPERATURE / DEPTH RECORDER — *46915*

12 16" GLASS BALLS IN HARD HATS ON 12 m 3/8" CHAIN

10 m 1/2" BRAIDED DACRON

ACOUSTIC RELEASE, TRANSPONDING

6 16" GLASS BALLS IN HARD HATS ON 6 m 3/8" CHAIN

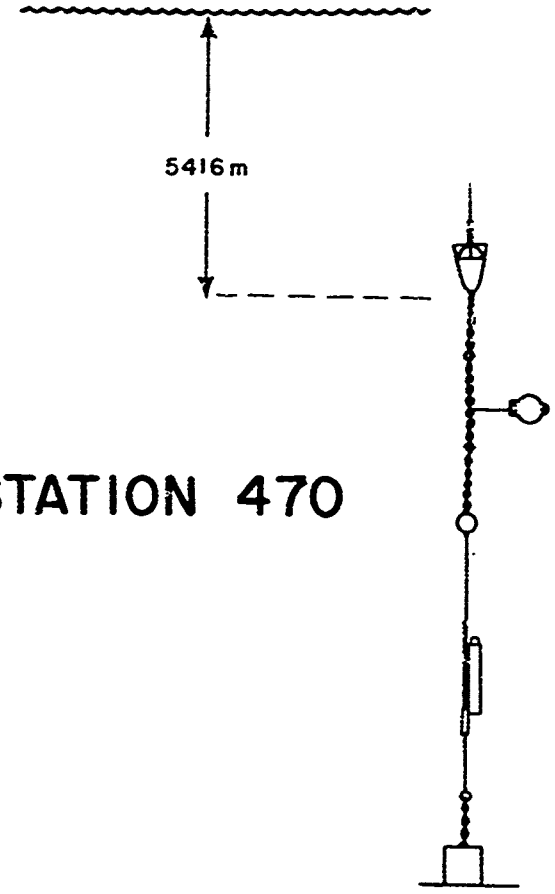
30 m 3/4" NYLON

ACOUSTIC RELEASE, TRANSPONDING

3 m 1/2" CHAIN

STIMSON ANCHOR, 2400 LBS WITH 32 FT. 1 1/8" CHAIN (320 LBS)

STATION 470



RADIO FLOAT
WITH LIGHT

2 m 1/2" CHAIN

6 17" GLASS BALLS IN HARD HATS ON 7 m 3/8" CHAIN

1m 3/8" CHAIN

TEMPERATURE / DEPTH RECORDER – *4701*

15 m 1/2" DACRON

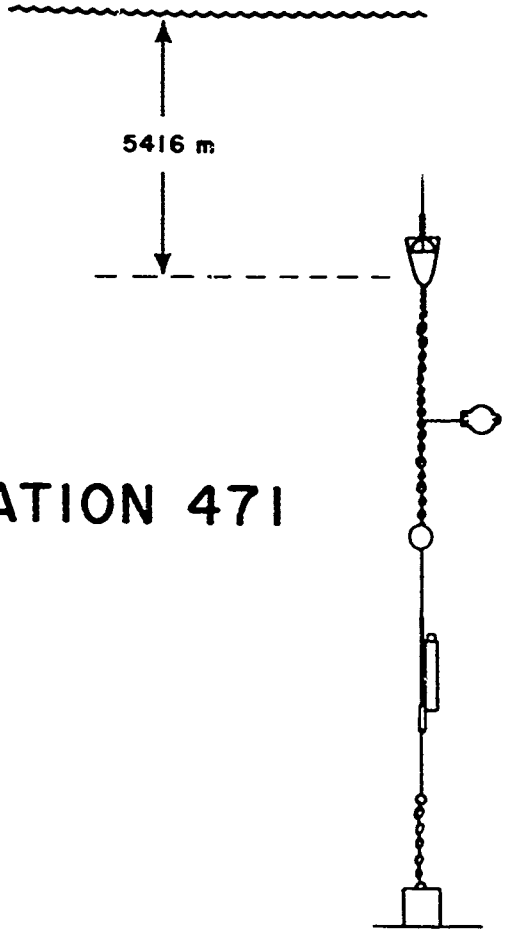
ACOUSTIC RELEASE, TRANSPONDING

15 m 1/2" DACRON

3 m 1/2" CHAIN

800 LB. CYLINDRICAL ANCHOR

STATION 471



RADIO FLOAT
WITH LIGHT

2 m 1/2" CHAIN

6 17" GLASS BALLS IN HARD HATS ON 7 m 3/8" CHAIN

1 m 3/8" CHAIN

TEMPERATURE / DEPTH RECORDER — *4711*

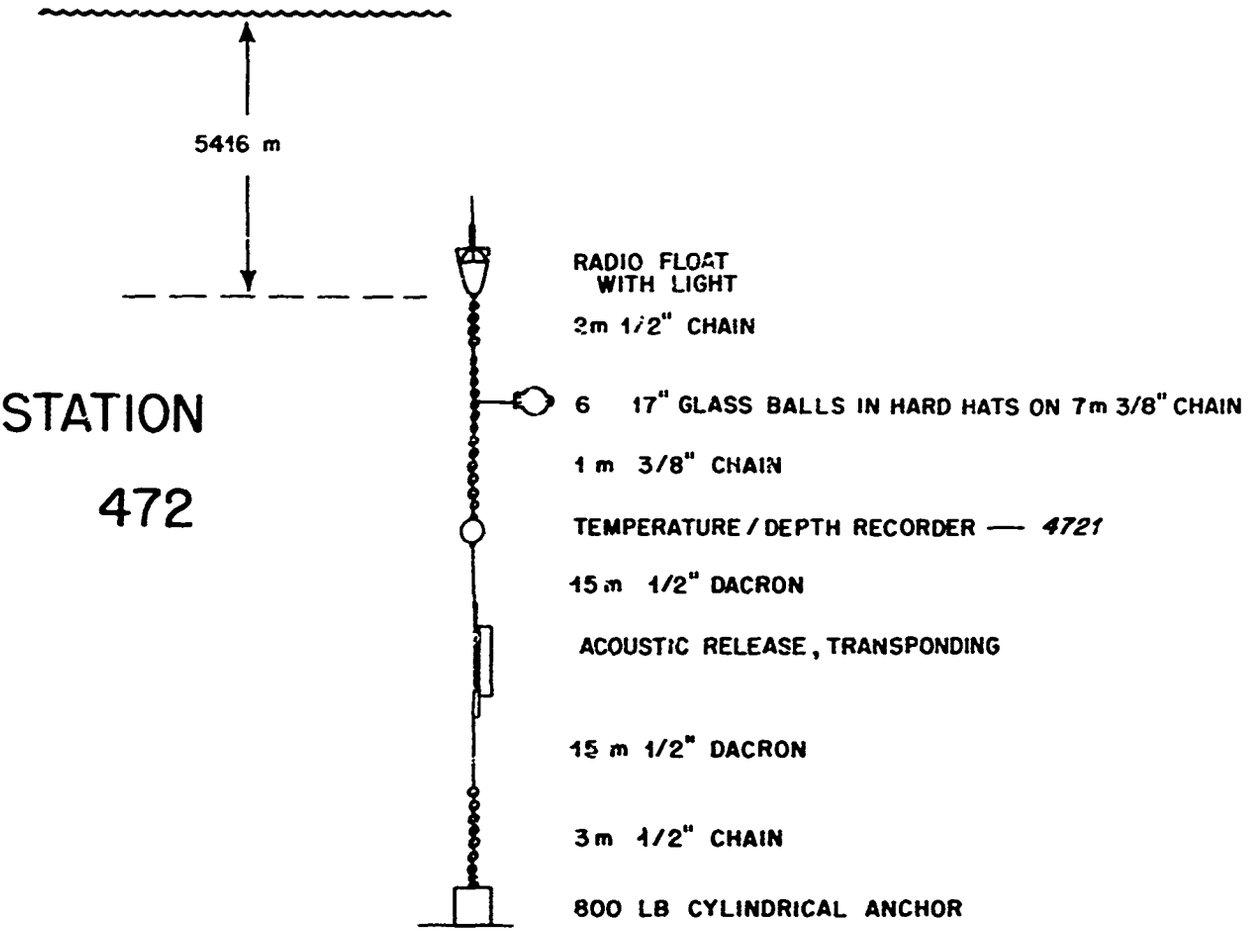
15 m 1/2" DACRON

ACOUSTIC RELEASE,
TRANSPONDING

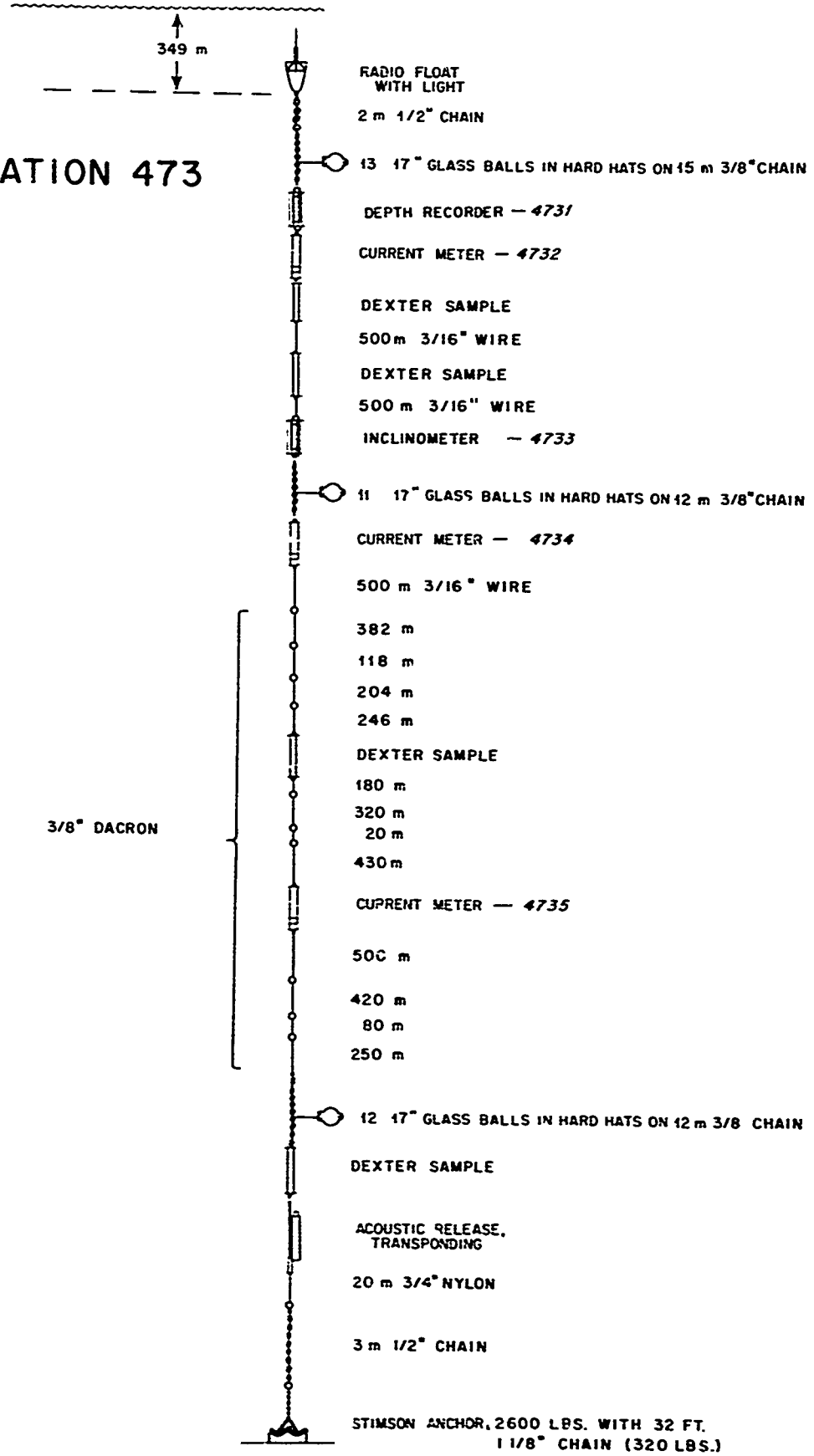
15 m 1/2" DACRON

3 m 1/2" CHAIN

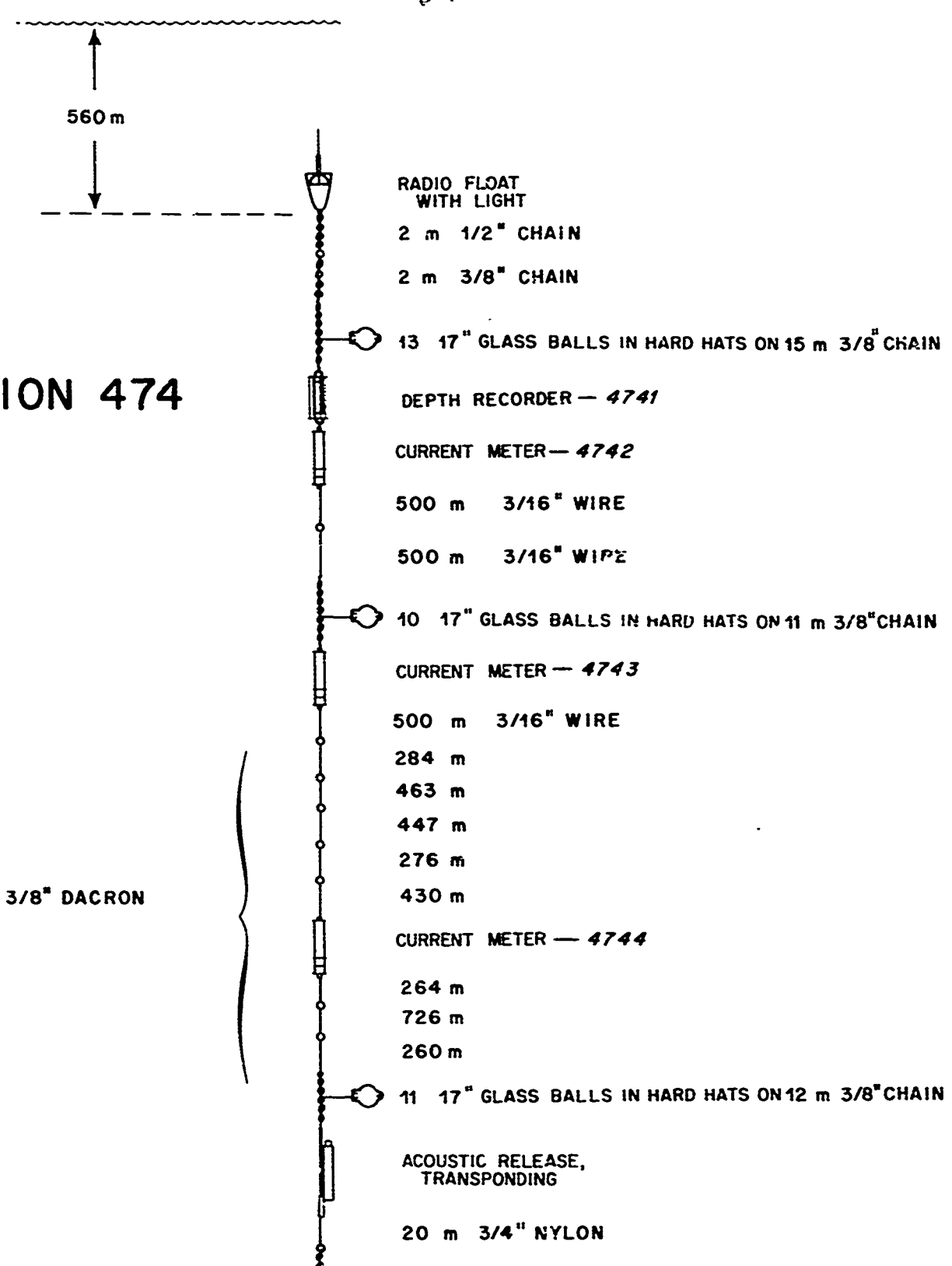
800 LB CYLINDRICAL ANCHOR


5416 m
STATION
472
RADIO FLOAT
WITH LIGHT
2m 1/2" CHAIN
6 17" GLASS BALLS IN HARD HATS ON 7m 3/8" CHAIN
1 m 3/8" CHAIN
TEMPERATURE / DEPTH RECORDER — 4721
15 m 1/2" DACRON
ACOUSTIC RELEASE, TRANSPONDING
15 m 1/2" DACRON
3m 1/2" CHAIN
800 LB CYLINDRICAL ANCHOR

STATION 473


349 m
RADIO FLOAT WITH LIGHT
2 m 1/2" CHAIN
13 17" GLASS BALLS IN HARD HATS ON 15 m 3/8" CHAIN
DEPTH RECORDER — 4731
CURRENT METER — 4732
DEXTER SAMPLE
500 m 3/16" WIRE
DEXTER SAMPLE
500 m 3/16" WIRE
INCLINOMETER — 4733
11 17" GLASS BALLS IN HARD HATS ON 12 m 3/8" CHAIN
CURRENT METER — 4734
500 m 3/16" WIRE
382 m
118 m
204 m
246 m
DEXTER SAMPLE
180 m
320 m
20 m
430 m
CUPRENT METER — 4735
50C m
420 m
80 m
250 m
3/8" DACRON
12 17" GLASS BALLS IN HARD HATS ON 12 m 3/8 CHAIN
DEXTER SAMPLE
ACOUSTIC RELEASE, TRANSPONDING
20 m 3/4" NYLON
3 m 1/2" CHAIN
STIMSON ANCHOR, 2600 LBS. WITH 32 FT. 1 1/8" CHAIN (320 LBS.)

STATION 474


560 m
RADIO FLOAT
WITH LIGHT
2 m 1/2" CHAIN
2 m 3/8" CHAIN
13 17" GLASS BALLS IN HARD HATS ON 15 m 3/8" CHAIN
DEPTH RECORDER — 4741
CURRENT METER — 4742
500 m 3/16" WIRE
500 m 3/16" WIRE
10 17" GLASS BALLS IN HARD HATS ON 11 m 3/8" CHAIN
CURRENT METER — 4743
500 m 3/16" WIRE
284 m
463 m
447 m
276 m
430 m
3/8" DACRON
CURRENT METER — 4744
264 m
726 m
260 m
11 17" GLASS BALLS IN HARD HATS ON 12 m 3/8" CHAIN
ACOUSTIC RELEASE,
TRANSPONDING
20 m 3/4" NYLON
3 m 1/2" CHAIN
STIMSON ANCHOR, 2350 LBS WITH 32 FT.
1 1/8" CHAIN (320 LBS)